

# Senior Citizens' learning safe behaviors on the web:

## A case study involving an online educational game

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### INTRODUCTION

While many different factors can undermine older people's ability to browse safely on the web, safety as an explicit aspect of integrated education for senior citizens is an underexplored topic in research. So, this chapter reports on a case study addressing safe behaviors through the implementation of an online educational game. It is crucial for seniors to learn and improve their digital skills, knowledge on how to browse on the web safely once seniors are increasingly present on the Internet and their level of confidence increases, not only due to the habit they develop in using the web as a daily medium, but also due to initiatives and actions by family members and entities, such as senior universities and government entities.

One way to promote this is through the concept of serious games, while introducing the cybersecurity content, preventive measures, and actions, in a novel way beyond traditional learning. First, as reported in the *Background* topic, the researchers analyzed the scientific literature focusing on serious games and crossed it with case studies on educational games targeting the seniors' population.

In the next phase of the study, the researchers started developing the game, gathering text and illustration content. After, a diagnostic study was made to better understand the actual seniors needs in their interaction with the online world.

The final step was developing the game further, recording all game concepts and the seniors needs, as reported in the subtopic *Developing the game*. Once all contents were in place, we made public the website Web Segura, presented in the section *The Game Web Segura*. *Future research directions* are presented in the end.

## BACKGROUND

In a short time, the Internet has become a central point in society. Daily routines require an Internet connection even in the smallest tasks. As society needs to be connected in the digital world, some people are still adapting to this new reality – seniors. Once seniors read the newspapers on paper, now they read on their smartphone or computer or playing board games with other people in the middle of the afternoon as an entertained and social moment, nowadays, they play online with long-distance friends and family. Even seniors didn't grow up with this new digital world, they want to keep up with this evolution and digital world. And it is great but has its dangers, especially for those how are totally comfortable online. The researchers understood that the learning mechanics of the serious games' challenges, motivates and behavior change influencer, therefore by improving their knowledge, attitude, cognitive abilities, according to Sousa *et al.* (2012) and Santos *et al.* (2016) skills according to Breuer, J., & Bente, G. (2010), seniors are more aware of the cybersecurity matters.

By promoting a serious game to seniors on the cybersecurity theme, the researchers study the design features that offer a positive experience and help focus on playful tasks that resemble their daily routines, without forcing their cognitive abilities and by eliminating barriers to the age of interaction games, as Chesham *et al.* (2017), said, and motivating their mental training and socialization, but certain characteristics, like children's game elements, can demotivate the seniors in their learning process according to Diaz-Orueta *et al.* (2012).

Nowadays, seniors have easy access to a mobile device and access to the dangers of online unsaved browsing, especially during the Covid-19 pandemic, where seniors found themselves lockdown at home, spending more time online, being the most vulnerable group to cyberattacks, social engineering, and misinformation due the digital illiteracy, lack of knowledge in cybersecurity, has said Poiares, N. (2019) and the lack of intellectual capacities to the understanding of the use of the Internet, according to Oliveira, M. (2019).

This digital illiteracy is a well-known problem, seniors when feeling distressed about browsing or using their device, seek help in their families and at present entities like the senior university, are seen as the most significant contribution, by offering ICT (Information Communication Technologies) classes to help senior in deepen their knowledge and practicing their know-how of the web browsing.

An ICT solution to help seniors improve their digital needs, in social and emotional well-being and health mental level, by enjoying the simplicity of the technology, but still senior have a fear of doing some wrong and then avoid and limited their online and digital tasks, like online shopping, said Coelho, A. (2019). Once seniors are more vulnerable to cyberattacks through social engineering, misinformation, digital illiteracy, malware attacks, phishing, these are some of the leading cybersecurity threats, according to Check Point Research (2021).

Therefore, it is essential for seniors to learn and improve their digital literacy, develop their skills on how to web browse safely and use social applications wisely, avoid the feeling of misunderstanding of the Internet and become more comfortable, connect with family and friends, and especially seniors also want to have fun and learn, and learning is a process for all ages.

Serious games gather the fun and the learning process, by potentially improving the cognitive functioning of seniors with a beneficial impact on daily their lives and improving their memory and attention, according to Fua *et al.* (2013). So serious games are a fundamental pillar in constructing the learning process theories, highlighting acquiring knowledge through exploration and gaming, according to De Gloria *et al.* (2014).

Consequently, this concept and a specific design for seniors, a serious game with cybersecurity content can help seniors overcome fears and the vulnerability of cyberattacks.

A study by Santos *et al.* (2016) and a study carried out by Blažič, B.J. & Blažič, A.J. (2020) shown to the researchers that presenting a serious game to seniors must have to be in two sessions. The first session was an experimental phase, where seniors play the game and get used to it, understanding the rules and

gameplay. Then, in the second session, seniors were evaluated in the learning skills through several questions, in which the study concluded that the game helped successfully seniors develop their literacy and digital skills, feeling more comfortable using a mobile device and web browsing after playing the adventure game. A third element was essential to ease the environment, a helping person or educator to help seniors in the game task and challenges, promote a safe environment, and positive emotions. A study by Kulkarni, V.K. (2019) on the cybersecurity topic, gave to the researchers a useful guideline in the development of cybersecurity capabilities and awareness and shown one of the biggest challenges was the game's design, due to the complexity of combining learning with the elements of motivation and entertainment.

## **A SERIOUS GAME FOR SENIORS**

Worlds collide – game as an educational element versus games as an entertainment element and online safety and digital literacy versus seniors that are not comfortable using these technologies and yet want to learn. Therefore, the researchers offer a chance to connect these different worlds, a serious game where seniors will learn about online safety and digital literacy concepts and have fun by playing and challenging themselves.

The researchers developed a serious game with online safety preventive measures and actions for seniors to understand, learn and apply this new knowledge in their daily live tasks and increase their confidence by self-taught independent by viewing all the alerts of potential dangers on online browsing and social interactions.

After an analyses of serious games criteria and taxonomies, the researchers can design a game prototype for seniors following the features:

- In the prototype phase, all the accessibility, usability, and response times are analyzed with testers, giving enough time to they to the tasks, without feeling under pressure. The same applies to seniors in the sessions.
- The game must be played on a personal device in which seniors must be familiar and comfortable with the device.
- The game must have a simple design and have elements of seniors' daily tasks.
- In the sessions, the room must have a welcoming and safe environment for seniors to feel comfortable.

And understanding the cognitive difficulties seniors have it was essential to do two or even three sessions, due to the Covid-19 pandemic, the sessions with seniors were reduced to one presential session. Before that session, the senior will have an e-mail explaining the aim of the game.

But before applying the game with the seniors, the researchers did a first survey to know the online safety and digital skills that seniors must better understand which topics the game will be focusing on.

After developing the game, the researchers enter in a prototype phase, testing and analyzing with three subjects. Then with all the data, information was gathered, and the final game was presented to the host entity – the Seniors' University of Leiria +60.

In future work, the game is played by seniors and after that, they are going to survey the web and gameplay usability. Short after, through an online survey, the same group will have to answer some questions about online safety matters to understand the effectiveness of the game.

## **Developing the game**

Before developing the game, the researchers had to understand the web usability for seniors, in the design phase of a game, its characteristics are defined from its genre to its platform which will be played, who are the players and the narrative, including levels and challenges, of the game, according to De Lope, R.P. & Medina-Medina N. (2017).

During this phase key elements for game development are also defined, according to De Lope, R.P. & Medina-Medina N. (2017) and Catalano *et al.* (2014):

- Adjusting the game's context to the learning objectives and the interaction capability of the players in the gameplay.

- Minimization of the cognitive load to maintain the level of attention, gameplay, and entertainment, but creating challenges to promote motivation in learning.

- Offer a constructive involvement in-game experience to the player, through active roles in game development, offering a collaborative decision between designers and players/testers.

- For the learning process to be easier, there are three key points presented to the players, the game purpose and learning purpose; rules and gameplay; during the gameplay support and offer guidance and in the end of the game, analyze if the learning experience has a success.

Once seniors' good mental health is a priority, the serious game is seen as a motor that promotes an improvement of seniors' cognitive abilities, just as focus, attention, memory, reaction speed, problem-solving, and above all fun, according to Kaufman *et al.* (2020), especially the digital games that have puzzles, cards, or online bingo, which are easy for seniors to recognize and understand.

For an online educational game to be more effective, it must respect two quality criteria:

- Easy to learn and user-friendly.
- Useful for daily tasks.

So, to develop the Web Segura game, there are some criteria and key points that the researchers focus on, according to the following table 1.

*Table 1. Criteria / Key points of developing the Web Segura game.*

Criteria / Key points	Description
Challenge	Adapt the game levels to the difficulty of the learning process, games pace, and senior's abilities.
Competition	Offer a score and goals to balance the senior's motivation and pressure.
Content	The language used in the content must be recognized by the seniors and the content must be relevant to the senior's life.
Feedback	Provide clear support responses, like success or failure messages) to help seniors understand the game.
Social Connection	Promote competition and cooperation between seniors' players, through scores.
Easy to use	Promote a consistent layout between different game screens, which must have only the most important information, and all game components, like navigation buttons, tutorials, scores, among others, must be visible on the game screen.
Readability	Provide a consistent text layout, organized with a clear font and with contrasts, with a vocabulary suitable for seniors, and provide the option to enlarge illustrative information
Equipment	Promote the usage of the mouse for browsing through the game but avoid double-clicking and use preferential large screens with good resolution for clear display of all game information.

Usefulness	To avoid cognitive overload for seniors, the information and learning content must be presented according to the levels of difficulty, in which the senior player is informed that the “easy” level corresponds to a basic level of knowledge, the game must have closed or multiple choice and limited questions.
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These are key points for the development of the Web Segura game, it is an online educational game, that promotes the logic, cognitive abilities of seniors played on a computer with a keyboard and mouse.

### *Architecture, platform, content, and interface of “Web Segura”*

Before developing the *Web Segura*, the researchers did a diagnostic study with an online survey to understand the knowledge of the Universidade Senior de Portugal students. The sample of the survey is quite small, only 26 respondents, because due to the Covid-19 pandemic, all the schools from this entity were close. Despite the setbacks, the survey data reveal important aspects.

This survey was developed according to the literature review, cybersecurity initiatives, studies, and statistics, having the following topics: social media, keywords, mobile device protection, online shopping and payments, social media, and fake news.

Demographic data have shown that most of the respondents were female, between the ages of 65 and 69 years old, with higher education than high school. When questioned about their technological equipment usage, the respondents use both personal computer and the touch-screen telephone regularly, especially to access the Internet to carry out their daily searches, read the news, browse for multimedia content, like videos on YouTube and pictures, and check e-mail and chat with family and friends, such as on Facebook and WhatsApp, regularly.

But when asked about online shopping, most of the respondents answered that they did not shop online. And yet, for those who did online shopping, purchase with ATM and/or collection upon delivery.

According to information and data made available by the Kuantokusta online platform, according to Marketeer (2021), the population over 65 years old increased by 240% when comes to online shopping in this online platform. Due to restrictions applied in the Covid-19 pandemic, seniors need to shop online. Therefore, is critical for seniors to learn how to be safe online and promote their digital literacy. Especially when comes to passwords, most of the respondents did not regularly change their passwords.

At last, when asked about their social interactions, the respondents showed good and safe online behavior, in the social media did not accept friendship request from unknown people, did not publish photos or videos, and did not share shocking or fake news, questioning the truth behind the news they are reading.

After this survey analyze, the researchers gather the important information and content for the game. While working on the content, making it more readable, simpler, and with a vocabulary for the seniors, the researchers also did a brief analysis of the platforms for the development of the game. In the end, the online platform of WordPress and the PH5 plugin were chosen. The PH5 is a plugin that helps develop games and questionnaires.

Before purchasing the domain – <https://websegura.pt>, the game was developed in a local workspace. In there all the plugins needed for the development were installed. The game was designed in a simple layout, with white background, black and blue lettering, and buttons, not to overload the senior player’s cognitive component.

All the games analyze before in the literature review were had an explanatory and interactive story, so the researchers taught at first the game will offer information on the topic and then offer a fun moment – a game. For this kind of development, the researchers used the Twinery platform, to sketch the flow of the game.

Next, gathering all information and game ideas, the researchers worked on the WordPress platform and PH5 plugin. This game, whose theme is online safety is composed of three pillars and to promote the dynamism of the content and the interaction with the user, a game was inserted in pages with more

information and explanations. In the design/prototype phase, the game had 24 pages with text content, images, and games and points to be collect by players.

In October and November 2021, the researchers start the testing phase, having three subjects with the following characteristics and experience, as seeing in the table 2.

*Table 2. Characteristics and experience of the subjects in the testing phase of the prototype game.*

Subject	Characteristics	Experience
A	Female 60 years old With the 4th grade education Recent user of online technologies	Version 1 – took 1h05min to complete. Felt that the game was too long. Felt that the game had a lack of interaction. Wanted more games to play. Had difficulty in maintaining attention
B	Female 65 years old Graduated Comfortable using online technologies	Version 2 – took 35min. Felt the game was easy to read and understand.
C	Male 70 years old With the 4th grade education Non-user of online technologies	Version 3 – did not finish. During the session, the subject learned how to use the mouse. Felt the game that some difficult tasks, due to inexperience in the use of digital resources, the subject already felt worn out. Felt that understood the contents that read.

After each subjects' experience, some corrections were made. In the first version were two major corrections made. The first correction was changing some words that were not usual in the day-to-day of the subjects, feeling they had difficulty in interpreting the text. And the second correction made was giving an illustrative example of the information in the page, for example, online shopping has an image with a website with a shopping cart.

Then the second version was tried by the second subject. In this version the major correction made was the need to have more games or more interaction, so after a big among of information on a page, the next page has a challenge with the information before.

The subjects all stated that the complexity and the information of the game and the understanding of the online safety content depend on the experience of each player.

In the final version, the prototype was concluded. The design and development of a serious game include several iterative and cyclic phases, according to Braad *et al.* (2016). The testing phase was completed, the following step was to transfer the local files to the online world, and yet in this phase, small corrections were made, like shortening some information.

## THE GAME *WEB SEGURA*

The researchers developed the *Web Segura* game dividing it into three topics – personal data, fake news, and online shopping. The web game has an SSL (Secure Sockets Layer) certificate, even though the web game does not ask for personal data, the researchers decided that for a good example, the web game must have a safe environment.

The first page is a welcoming page, where the player clicks on the image “start”, then is shown an introduction about the following contents, as shown in the figure 1.



*Figure 1. Welcoming page of the Web Segura game.*

*Source: Web Segura (2022)*

The topic of personal data is divided into four subtopics:

I. Passwords – after explaining the concept of passwords and how to build a strong password, the player has to do a challenge, where the player has to drag three words into boxes to build a strong password that is “Aminhap4l4vr4-chaveÉforte!” – this example of a strong password is built by having capital letters (A / É), lowercase (minha / chave / forte), numbers (p4l4vr4), special characters (- / É / !). In the end, the player wins 1 point, as shown in the figure 2.



Figure 2. First challenge of the subtopic Passwords.  
Source: Web Segura (2022)

II. Online Services Policies – in this subtopic some characteristics of a safe website are explained, like the lock and the https:// in the domain. After, the player must analyze an image and answer the question “Is the website true or false?”. The player must answer it is true, then wins 1 point, as shown in the figure 3.





*Figure 3. Challenge of the subtopic Online Services Policies.  
 Source: Web Segura (2022)*

III. The subtopic of mobile devices explains that all devices must update themselves and all applications, to avoid bugs and errors. Next, the player must answer true to the following question “we should allow the smartphone its security application?” then the player wins 1 point, as shown in the figure 4.

 **Desafio dos Dispositivos móveis**

Verdadeiro ou Falso?



Devemos sempre permitir o **telefone atualizar a segurança**, como na imagem acima. Esta afirmação é verdadeira ou falsa?

☐ Verdadeiro ☐ Falso

Este desafio oferece 1 ponto ★



*Figure 4. Challenge of the subtopic Mobile devices.  
Source: Web Segura (2022)*

IV. Online advertising – in this subtopic the player is presented with some advice to suspect when a website shows a lot of pop-ups, as shown in the figure 5.

## Publicidade online

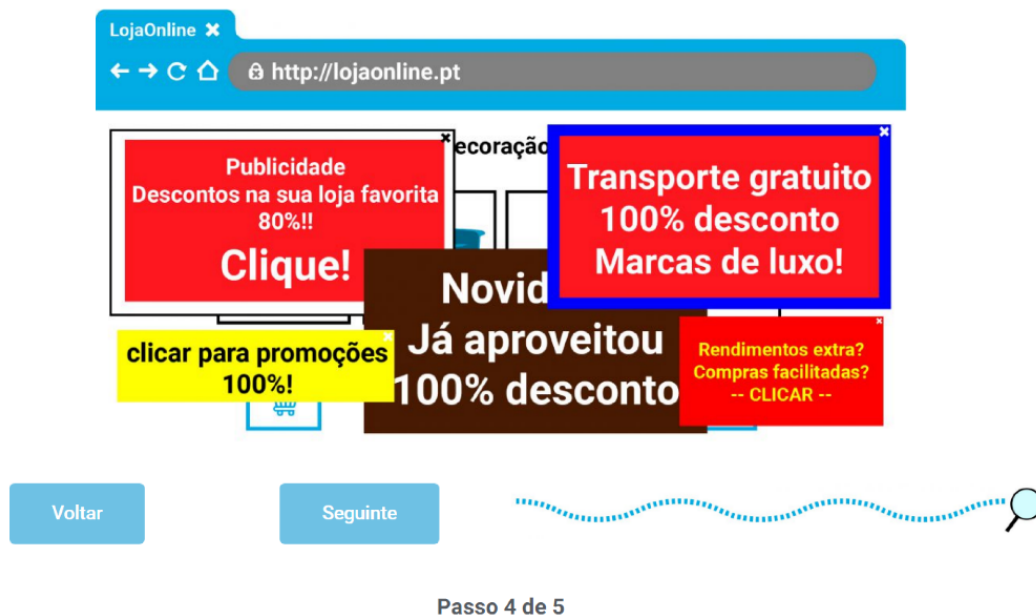
Quando navegamos pela web, vamos aceder a serviços online como websites e lojas online. Estas geralmente **apresentam uma janela logo ao início ou quando entramos**.

São chamados os **pop-ups** e às vezes **dificultam um pouco a leitura** da informação.

Para **remover** estes pop-ups, **clicamos e acabamos por ir parar a outro website**.

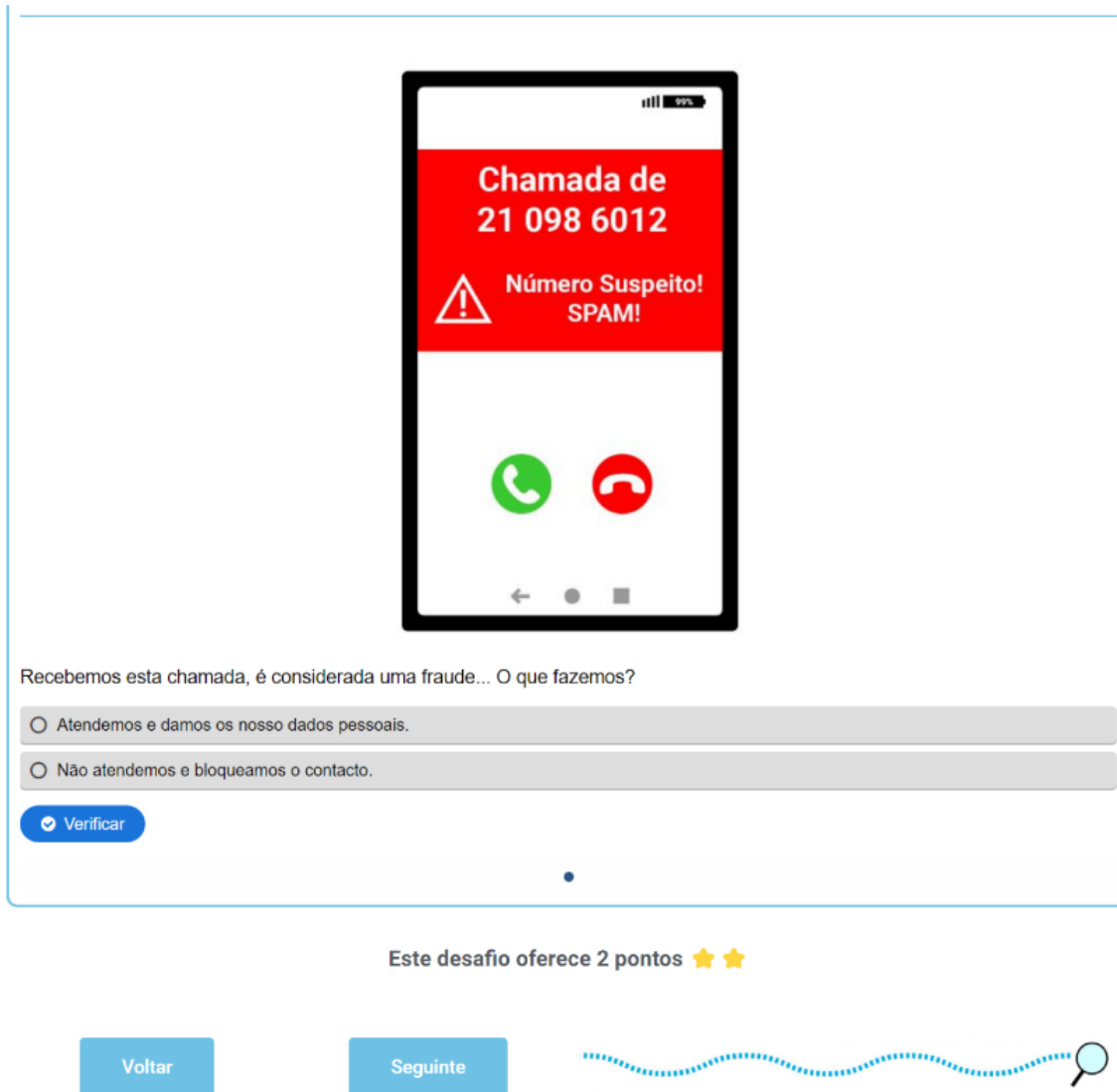
Infelizmente, são websites que nos tentam **vender produtos/serviços enganosas**.

Existem muitos **malfeitores que querem obter os nossos dados**, e **oferecem pedras preciosas – nem tudo que reluz é ouro** ☀.



*Figure 5. Subtopic Online advertising.  
Source: Web Segura (2022)*

V. Social frauds – like the previous subtopic, it is explained to the player some advice and information to keep in mind when a suspicious person talks through social media chats or when receiving a suspicious e-mail, what to do. Next, the player must analyze two images and answer according to what was previously explained. In the end, the player wins 2 points, as shown in the figure 6.



*Figure 6. Challenge of the Subtopic Social frauds.  
Source: Web Segura (2022)*

To end this topic, the player must win the final challenge of level 1, it is a matching picture together. First, the player sees and reads the caption of the images before matching it, for example, the image of the suspicious friend request matches the hacker person image. In the end, the player wins 5 points, as shown in the figure 7.

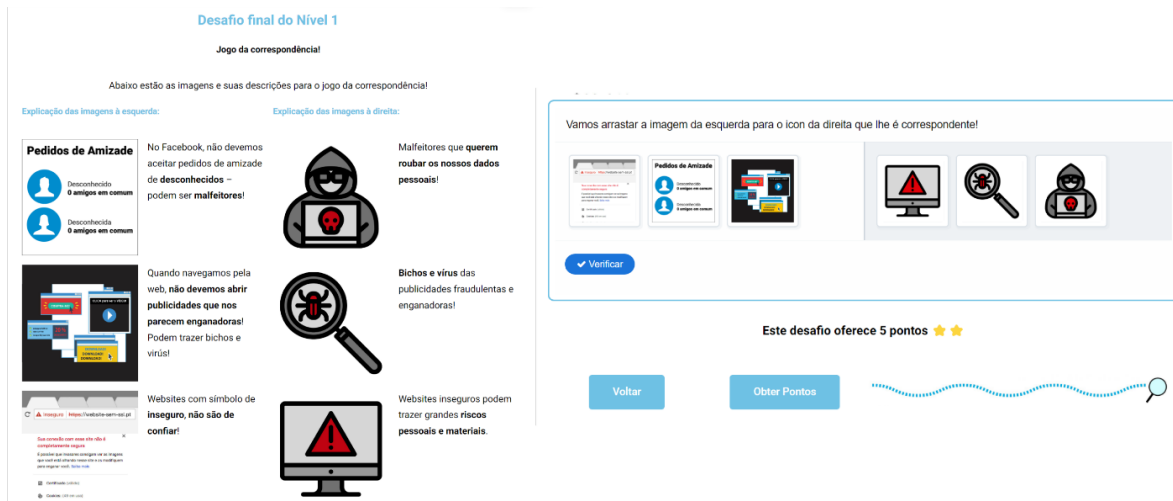


Figure 7. Last challenge of the topic of Personal data.  
Source: Web Segura (2022)

At the end of level 1, the player receives congratulations and all the points (10). Then, the player goes to level 2, as shown in the figure 8.



Figure 8. First level concluded.  
Source: Web Segura (2022)

In level 2 the topic is fake news, where the concept of fake news is explained and six pieces of advice are presented, like reading news with critical thought, when browsing in a website see if it has the https:// or the lock, never share suspicious news on social media and look up the information in trusted sources, as shown in the figure 9.

### **Conselhos sobre Notícias Falsas**

**1 Olhar crítico ao ler as informações** que estão apenas online sem qualidade e sem autor conhecido e comunicação social conhecida agregada.

E ainda existem **websites falsos que nos podem levar a criar contas e roubar-nos dados pessoais**. Para evitar entrar ou acreditar em websites assim, podemos analisar os seguintes pontos:




 No link do website verificar se contém o seguinte – **https**  – isto significa que o **website é seguro** pois tem um **certificado de segurança** e **guarda os nossos dados de forma segura e encriptado** .



Figure 9. One of the six pieces of advice in the topic of Fake news.  
Source: Web Segura (2022)

To conclude this level, the player must analyze three images and drag the option of “fake news” or “true news” to the image. In the end, the player wins 15 points. At the end, the player receives congratulations and all the points by now are 25 points, as shown in the figure 10 and figure 11.

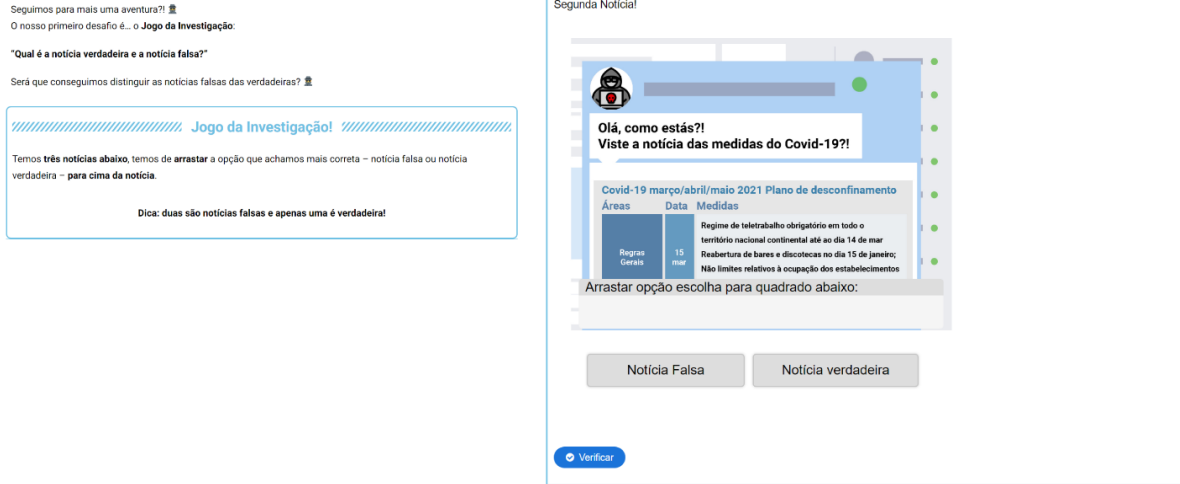


Figure 10. Final challenge of the topic of Fake news.  
Source: Web Segura (2022)



Then the player goes to level 3, the online shopping. This topic is a bit more complex and longer. Once seniors are not comfortable with online shopping, the researchers wanted to be more explanatory in this topic and bring more fun to the moment.

First, the player is presented with an explanation of the online shopping concept and an example of an online store image, and a list of the online store policies, like the terms and conditions, terms of privacy, payment methods, refunds. Next, the player has the memory game to play, connecting two identical images,

when the player matches the pictures is presented an explanation of the images. In the end, the player wins 3 points, as shown in the figure 12.

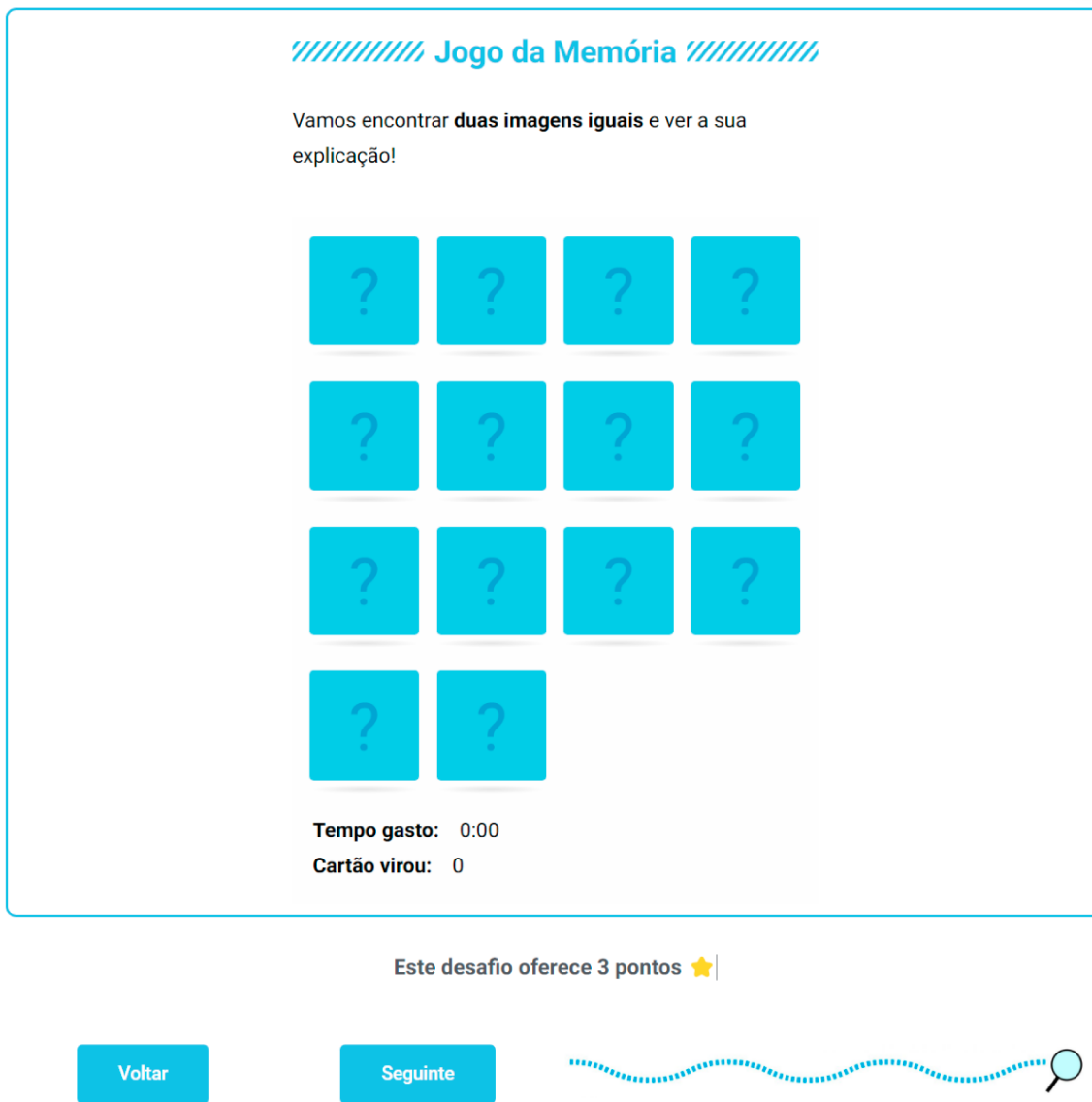


Figure 12. Challenge of the memory game.  
Source: Web Segura (2022)

Since the payment methods is a piece of sensible information, the researchers dedicated a subtopic to this, explaining all the methods legal in Portugal. Then the player must analyze three images, one of the ATM references, the other of PayPal, and other of MBWAY application, and answer three questions about them. In the end, the player wins 3 points, shown in the figure 13.










//////////////////// Joga da resposta única //////////////////////

Abaixo temos um jogo com **três perguntas**, será que acertamos nas respostas certas?!




As referências multibanco são...

Uma transferência internacional.

Método de pagamento realizado numa caixa de multibanco ou através da aplicação do nosso banco online.

---




O PayPal é o método de pagamento mais seguro online. O que é preciso para usar este método?

Ter uma conta na plataforma PayPal, concedendo dados como nome, morada, telefone, correio eletrónico/e-mail e o cartão bancário.

Apenas uma morada para disponibilizar pagamento à cobrança.

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Existe uma aplicação nos dispositivos móveis que permite realizar transferências online imediatas apenas com o número de telefone. Como se chama?

MBWay

Transferência bancária

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Este desafio oferece 3 pontos ★

Voltar Seguinte




Figure 13. Challenge of the payment methods subtopic.  
Source: Web Segura (2022)

Next, the player is presented with some alerts of online shopping, like never giving the credit card number or using reliable applications to deal with online negotiations. To explain more of this kind of alert, the player has the memory game to match two identical images and receive some advice after. In the end, the player wins 3 points.

In the subtopic alerts of online shopping, the fake website of TAP study case is presented to the player, where the player must analyze the website image and answer if it is fake or a true and reliable website. In the end, the player wins 1 point, shown in the figure 14.

////// Jogo do Verdadeiro ou Falso ////

TAP x

← → ↻ ⌂ http://flytap-pt.club

**TAP PORTUGAL**

Friday, 11 October 2019

**Estamos celebrando nosso 75º aniversário e dando 2 ingressos grátis para todos!**

**Bilhetes restantes: 105**

**Por favor, responda a questão abaixo primeiro:**  
**Pergunta: Alguma vez voou com a TAP Air Portugal?**

**Sim**

**Não**

Acima encontramos uma imagem do website a representar a companhia aérea TAP.  
 Analisando corretamente, podemos afirmar que é **um website suspeito**, pois não tem **cadeado nem HTTPS** antes do **www**.  
 Portanto, é um website...?

☐ Verdadeiro ☐ Falso

**Verificar**

Este desafio oferece 1 ponto ★

**Voltar** **Seguinte**

*Figure 14. Challenge of the fake TAP website study case.*  
 Source: Web Segura (2022)

Still, on this subtopic of the alerts, the player is presented with information of online buying tickets (sports, music, cultural events), some do's and don'ts. At the end, the player must answer a question about a situation of online buy when a musical festival ticket is sold out. In the end, the player wins 1 point. Next, the player must answer a question about online credits, but previously has the explanation of the concept of the online credit and what not to do when a great deal appears. To win another 1 point, the player is questioned about a website that is selling great online credit, shown in the figure 15.

//////////////////// Jogo do Crédito Falso ou Verdadeiro ////////////////////

Créditos x

← → ↻ 🏠 http://creditos-maravilhosos.falso

Crédito
Crédito Consolidado
Soluções Crédito
Estado do Pedido
Contactos

O MELHOR CRÉDITO DO MERCADO!

FINANCIAMENTO DE 6.000€ A 84 MESES

TAN: 4,5%

TAEG: 5%

PEDIDO 100% ONLINE  
RESPOSTA EM 24H

Acima temos uma imagem de um **website que afirma ter um crédito espetacular** e precisamos de fazer umas mudanças lá em casa.

Mas sentimos que qualquer coisa está errada. Vamos fazer uma investigação:

- Vemos se todos os dados e contactos do website são **falsos**.
- Vemos se o website **não tem o cadeado e se tem HTTPS** no link.

E concluímos que este **website é suspeito**. Portanto este é um caso de um website verdadeiro ou falso?

☐ Verdadeiro

☐ Falso

🔍 Verificar

Este desafio oferece 1 ponto ★

Voltar

Seguinte

*Figure 15. Challenge of the online credit card subtopic.  
Source: Web Segura (2022)*

To finish this subtopic, the online sale of counterfeits is presented to the player, because on the Internet everything not quite branded is easily selling, deceiving the less experience in seeing something is wrong. So, in the end, to win 3 points, the player must analyze two images, one of a fake online store and the second is an image of a deceiving person trying to sell something bad to a person through social media chats, shown in the figure 16.

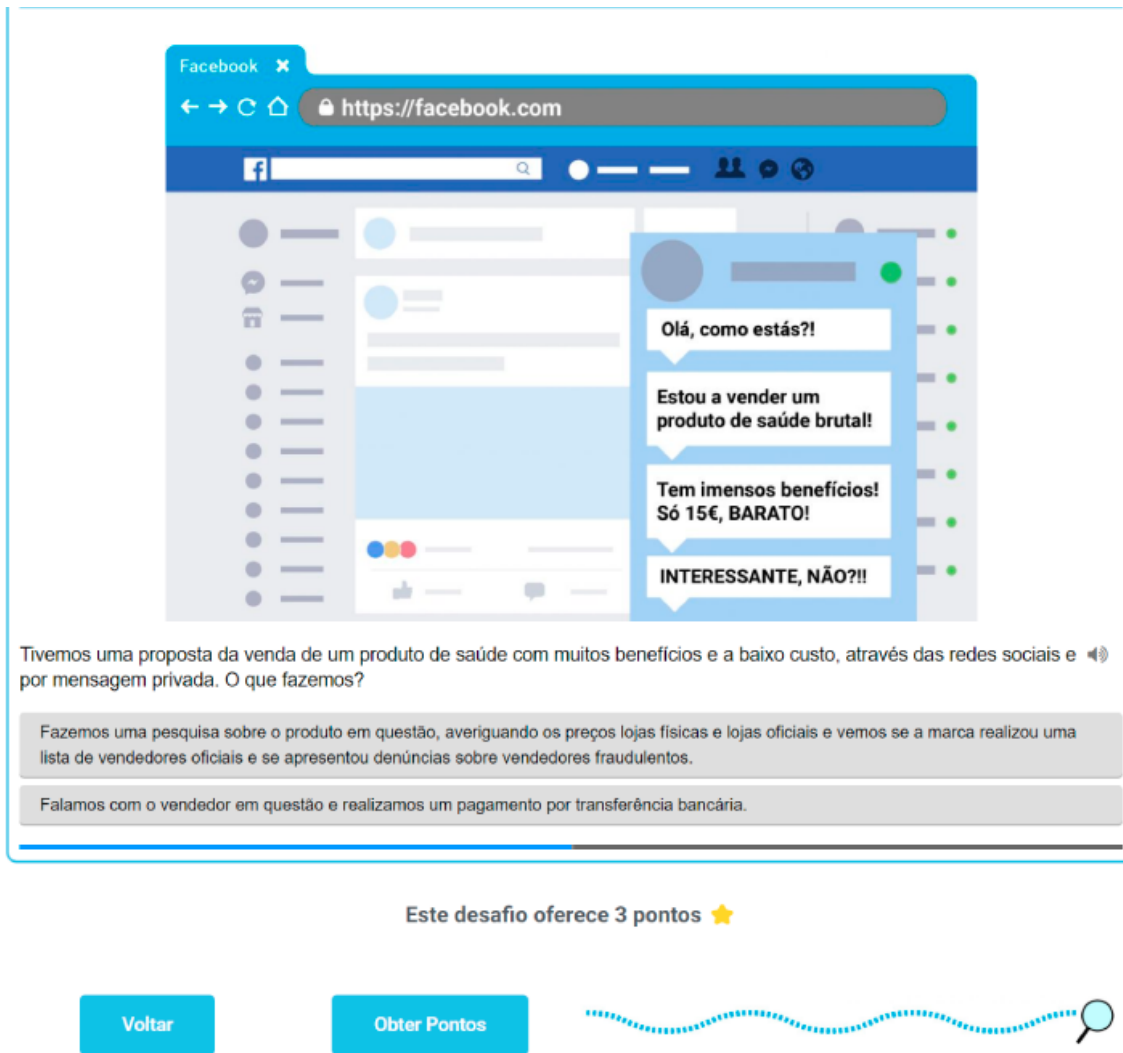


Figure 16. Challenge of the online sale of counterfeits subtopic.  
Source: Web Segura (2022)

Reaching the last part of the Web Segura game, the player receives congratulations and all points deservedly won – 40 points, shown in the figure 17.



Figure 17. Conclusion of the Web Segura game.  
Source: Web Segura (2022)

The game session is finished.

## FUTURE RESEARCH DIRECTIONS

In the near future, the *Web Segura* game will be played by senior students at the Seniors' University of Leiria +60 of Leiria. At the end of the game session, a web/game usability survey is asked to fill by the senior students. The senior students must choose between 1 (strongly disagree) and 5 (strongly agree) to answer questions on game experience, learning experience, adaptability, usability, and loyalty. Table 3 resumes those dimensions, their attributes, and their questions/items.

Table 3. Dimensions, attributes and items of the web and game usability survey.

Dimensions	Attributes	Items
Game experience	Challenge	The experience was challenging. I found the game stimulating.
	Competence	I achieve the goals of the game
	Flow	I stayed focused throughout the game.
	Immersion	The experience was immersive.
	Affection	The experience was positive.



	Tension	Interactions with the game left me feeling overwhelmed and tense.
Learning experience	Learning objective	The game's learning objectives were clear.
	Content adequacy	The game has relevance to the issue of digital skills development and web safety/security.
	Integrity	The game allowed me to use my digital skills and web safety/security.
	Feedback	The game provided feedback when needed.
	Extensibility	I recognize the value of the game as a learning tool.
	Correspondence multimedia content	Using the investigator role was an appropriate way to develop digital skills and web security.
Adaptability	Cognitive and Motivation	The tutor's interventions helped me to stay focused on the game.
	Intervention	The tutor's interventions helped my self-confidence during the game.
	Game rhythm	The pace of the game was too fast for me.
Usability	Interface	The game interaction area was easy to use.
	Interaction	<p>The game's website was easy to deal with initially.</p> <p>I learned to use the game's website with ease.</p> <p>It was easy to click the buttons in the game.</p> <p>It was easy to carry out the tasks of the game.</p> <p>Overall, it was easy to use the game's website.</p> <p>I found the game's website complex.</p> <p>I think I would need help and support from to be able to use the game's website.</p> <p>I found there was an inconsistency when using the game's website.</p> <p>I imagine most people could learn the game easily and quickly.</p> <p>I found the game's website very complicated to use.</p> <p>I felt confident using the game's website.</p> <p>I felt I needed to learn more about how to use a website before starting the game.</p>
Loyalty	Visual aspect	<p>The game had an appealing visual immersion.</p> <p>The game had a simple, objective look and presentation.</p> <p>Overall, I found the game attractive.</p>
	Identification	I identified myself with the role of game investigator.
	Likelihood	I identified myself with the game's story. The game experience was real.

To understand if the game design, the text contents or information, the multimedia contents were enough for the seniors' students and players to learn the principal question of web safety and what kind of online threats exists and if they had a good moment and experience in the session.

In the short-term, the researchers will deploy an online survey with questions about the contents of the game, to understand if the seniors can recall all the information.

## CONCLUSION

The development of the Web Segura game was a challenge for the researchers, since the target audience had not fully develop their digital skills, so many information and content had to be explained and simplified before the target audience could understand without getting frustrated.

During the prototype and testing phases, researchers gathered true knowledge on how the user with good digital skills, or the user without any experience, would perform with the game. Also, the researchers studied the interface usability for this target audience and refined the game as best as possible, with a

simpler design, more contrasts for readable content, writing with a more familiar language, and applying visual material, easy to understand and associate with the daily tasks of the target audience.

According to the diagnostic study guiding the development of the game, the students at the senior's university – Universidade Senior de Portugal – are users with a previous experience obtained in ICT class. So far, the researchers feel confident that the game will be a success. In any case, the study provides insights to other researchers with this framework dealing with games for seniors. Also, it carries practical implications regarding technological readiness for internet navigation in a safe way.

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## KEY TERMS AND DEFINITIONS

**Serious Game:** is a game typology that gathers the fun component and the learning process, developing cognitive and physical-motor skills and abilities.

**Digital Skills:** the ability to autonomously access digital media and Information Communication Technologies and understand and evaluate the content on the web.

**Fake News:** news that gather shocking and fake content to exploit angry and sad feelings on online users, making them promote and share the fake news.

**Online Shopping:** is an activity/action of buying services or product through the Internet.

**Senior Citizens:** individuals over 60 years old, that now have the skills and financial flexibility to create opportunities in the technological and educational aspects.

**Cybersecurity:** is a skill or capability, activity, or process by which Information and Communication Systems and Data are protected against damage, unauthorized use or any type of modification or exploitation.

**Personal Data:** all kind of information that identifies an individual, like identification number, credit card number.